

field which would be obtained from a perfect antenna of the height specified by Figure 7 of § 73.190 for operation on frequencies below 750 kHz.

[28 FR 13574, Dec. 14, 1963, as amended at 31 FR 8069, June 8, 1966; 33 FR 15420, Oct. 17, 1968; 44 FR 36038, June 20, 1979; 50 FR 18844, May 2, 1985; 51 FR 2707, Jan. 21, 1986; 51 FR 4753, Feb. 7, 1986; 52 FR 10570, Apr. 2, 1987; 56 FR 64868, Dec. 12, 1991]

§ 73.190 Engineering charts and related formulas.

(a) This section consists of the following Figures: 2, r3, 5, 6a, 7, 8, 9, 10, 11, 12, and 13. Additionally, formulas that are directly related to graphs are included.

(b) Formula 1 is used for calculation of 50% skywave field strength values.

FORMULA 1. Skywave field strength, 50% of the time (at SS+6):

The skywave field strength, $F_c(50)$, for a characteristic field strength of 100 mV/m at 1 km is given by:

$$F_c(50) = (97.5 - 20 \log D) - \left(2\pi + 4.95 \tan^2 \phi_M \right) \sqrt{\left(\frac{D}{1000} \right)} \quad dB(\mu V/m) \quad (\text{Eq. 1})$$

The slant distance, D , is given by:

$$D = \sqrt{40,000 + d^2} \quad km \quad (\text{Eq. 2})$$

The geomagnetic latitude of the midpoint of the path, Φ_M , is given by:

$$\Phi_M = \arcsin[\sin a_M \sin 78.5^\circ + \cos a_M \cos 78.5^\circ \cos(69 + b_M)] \quad \text{degrees} \quad (\text{Eq. 3})$$

The short great-circle path distance, d , is given by:

$$d = 111.18d^\circ \quad km \quad (\text{Eq. 4})$$

Where:

$$d^\circ = \arccos[\sin a_T \sin a_R$$

$$+ \cos a_T \cos a_R \cos(b_R - b_T)] \quad \text{degrees} \quad (\text{Eq. 5})$$

Where:

a_T is the geographic latitude of the transmitting terminal (degrees)

a_R is the geographic latitude of the receiving terminal (degrees)

b_T is the geographic longitude of the transmitting terminal (degrees)

b_R is the geographic longitude of the receiving terminal (degrees)

a_M is the geographic latitude of the midpoint of the great-circle path (degrees) and is given by:

b_M is the geographic longitude of the midpoint of the great-circle path (degrees) and is given by:

$$a_M = 90 - \arccos \left[\sin a_R \cos \left(\frac{d^\circ}{2} \right) + \cos a_R \sin \left(\frac{d^\circ}{2} \right) \left(\frac{\sin a_T - \sin a_R \cos d^\circ}{\cos a_R \sin d^\circ} \right) \right] \quad (\text{Eq. 6})$$

$$b_M = b_R + k \left[\arccos \left(\frac{\cos \left(\frac{d^\circ}{2} \right) - \sin a_R \sin a_M}{\cos a_R \cos a_M} \right) \right] \quad (\text{Eq. 7})$$

Note (1): If $|F_M|$ is greater than 60 degrees, equation (1) is evaluated for $|F_M| = 60$ degrees.

Note (2): North and east are considered positive; south and west negative.

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Note (3): In equation (7), $k = -1$ for west to east paths (i.e., $b_R > b_T$), otherwise $k = 1$.

(c) Formula 2 is used for calculation of 10% skywave field strength values.

FORMULA 2. Skywave field strength, 10% of the time (at SS+6):

The skywave field strength, $F_c(10)$, is given by:

$$F_c(10) = F_c(50) + \Delta \quad \text{dB}(\mu\text{V/m})$$

Where:

$$\Delta = 6 \text{ when } |F_M| < 40$$

$$\Delta = 0.2 |F_M| - 2 \text{ when } 40 \leq |F_M| \leq 60$$

$$\Delta = 10 \text{ when } |F_M| > 60$$

(d) Figure 6a depicts angles of departure versus transmission range. These angles may also be computed using the following formulas:

$$\theta^\circ = \tan^{-1} \left(k_n \cot \frac{d}{444.54} \right) - \frac{d}{444.54}$$

Where:

d=distance in kilometers

n=1 for 50% field strength values

n=2 or 3 for 10% field strength values and where

K₁=0.00752

K₂=0.00938

K₃=0.00565

NOTE: Computations using these formulas should not be carried beyond 0.1 degree.

(e) In the event of disagreement between computed values using the formulas shown above and values obtained directly from the figures, the computed values will control.

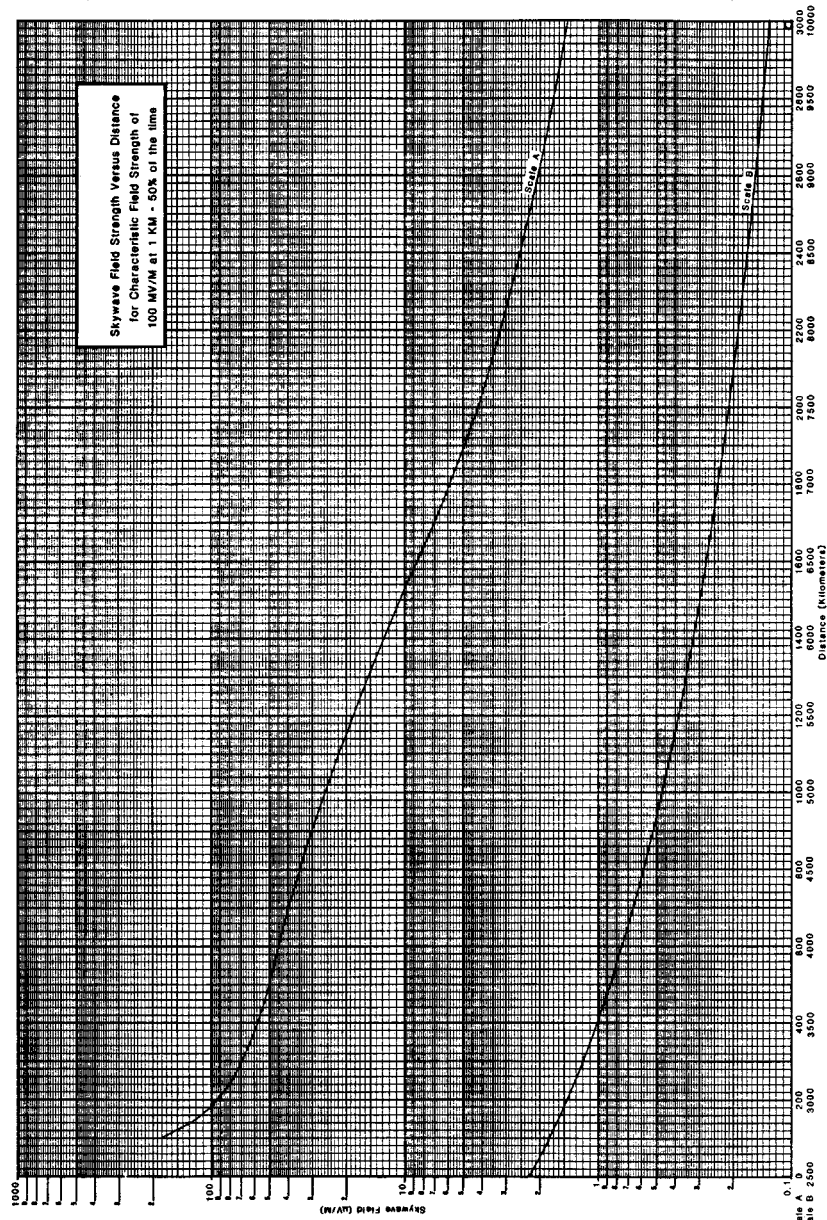
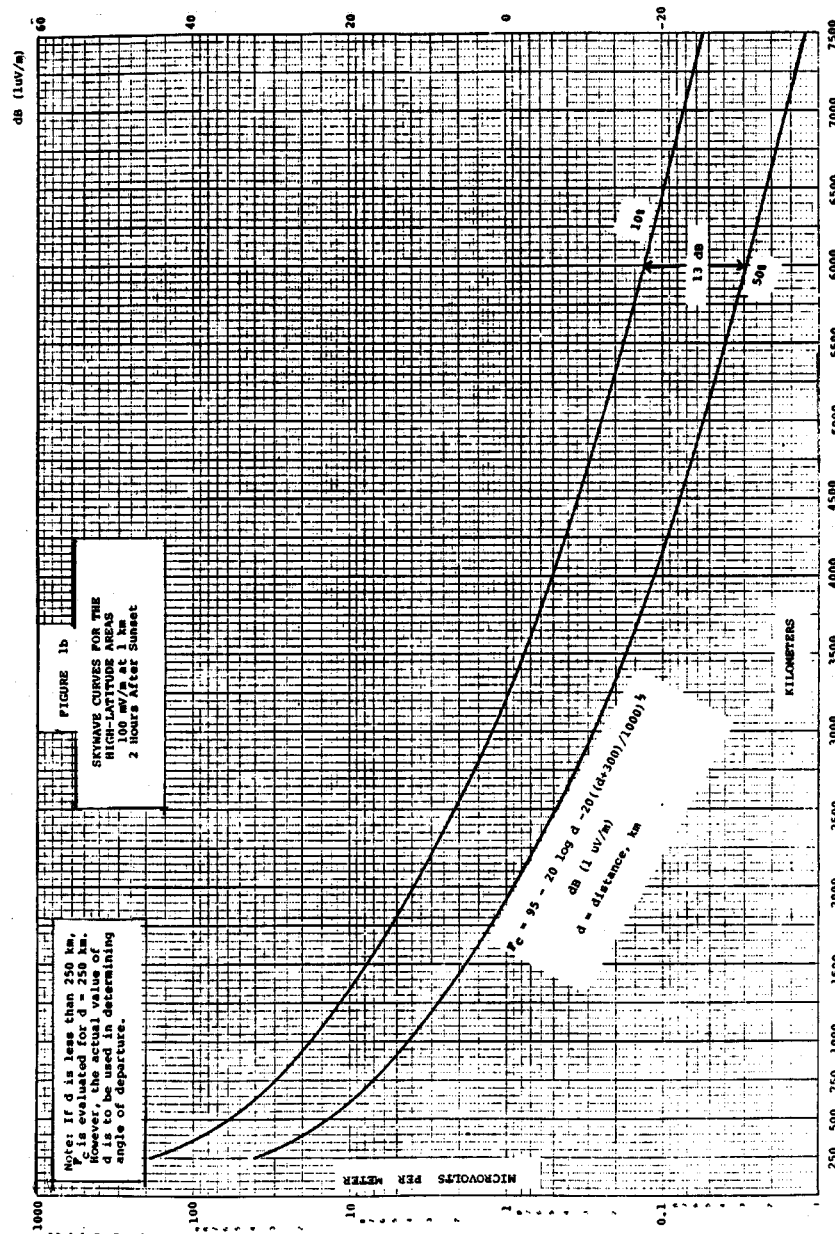
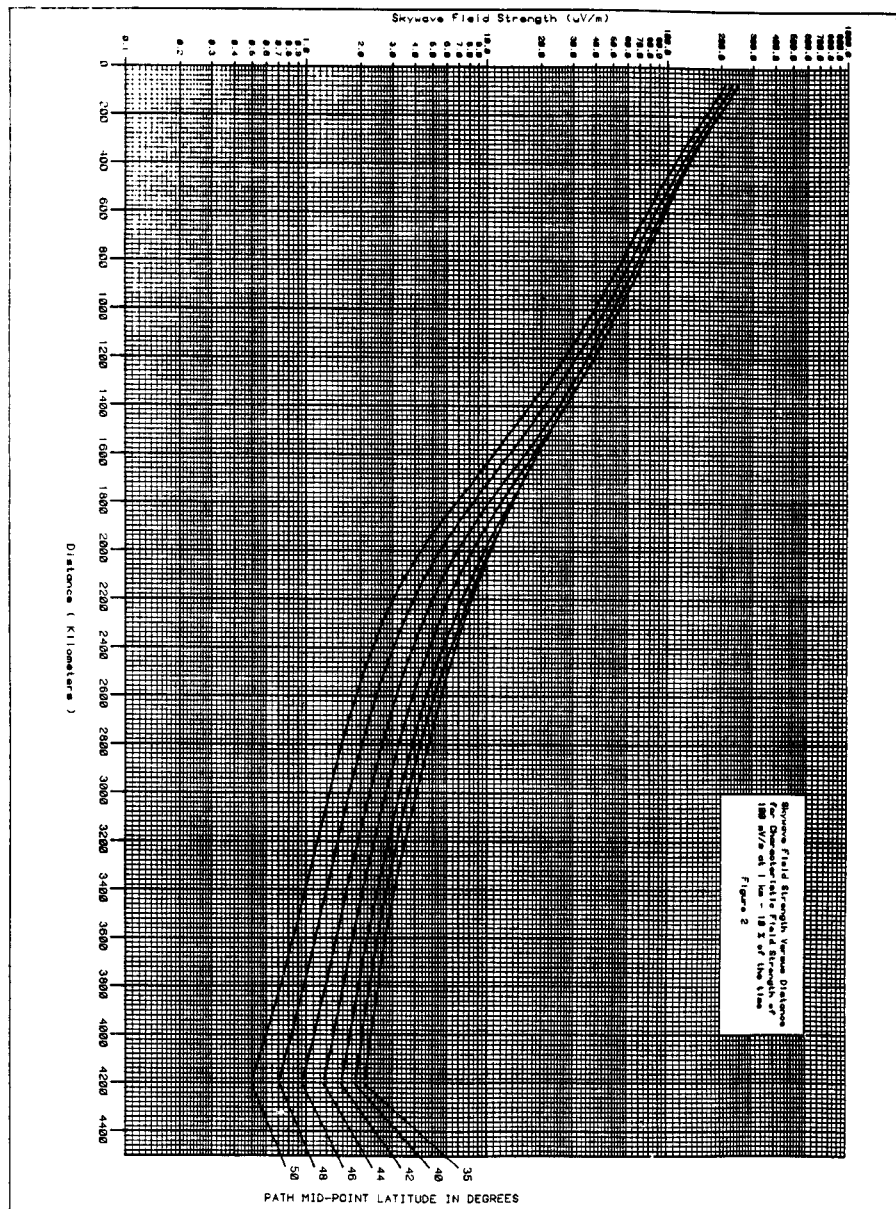


Figure 1a





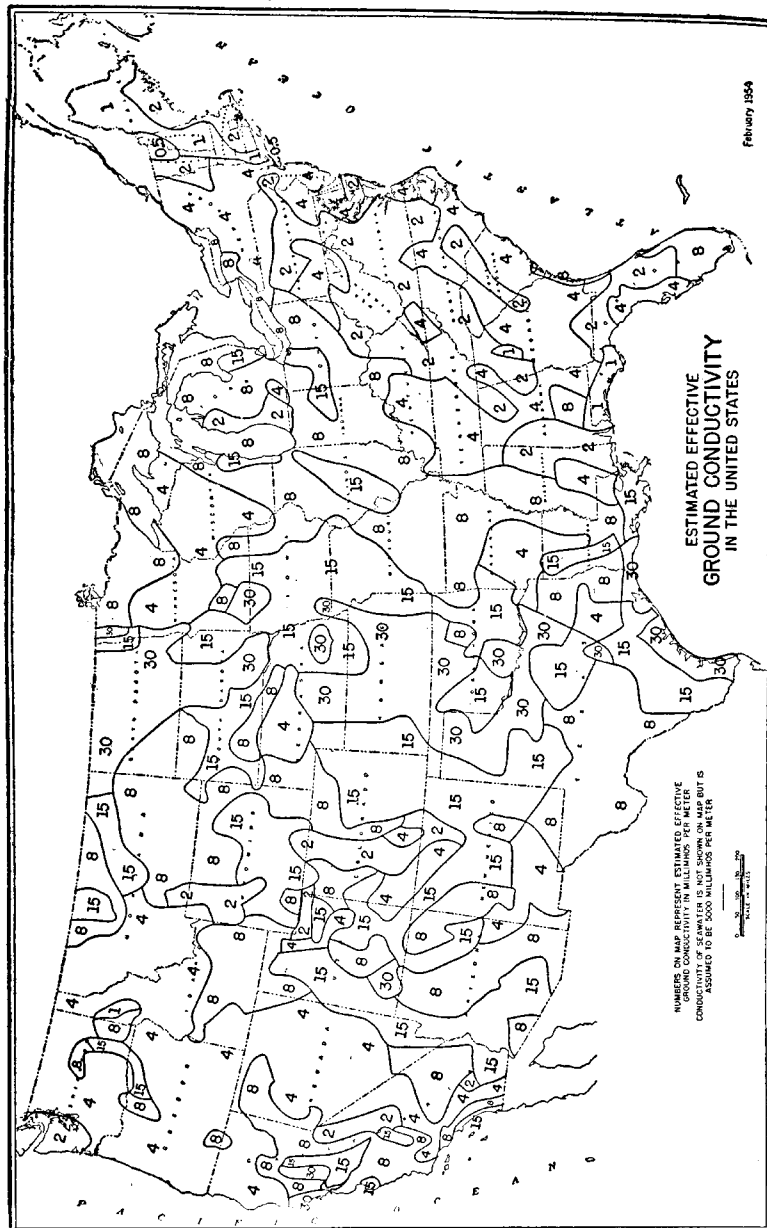


FIGURE R3.

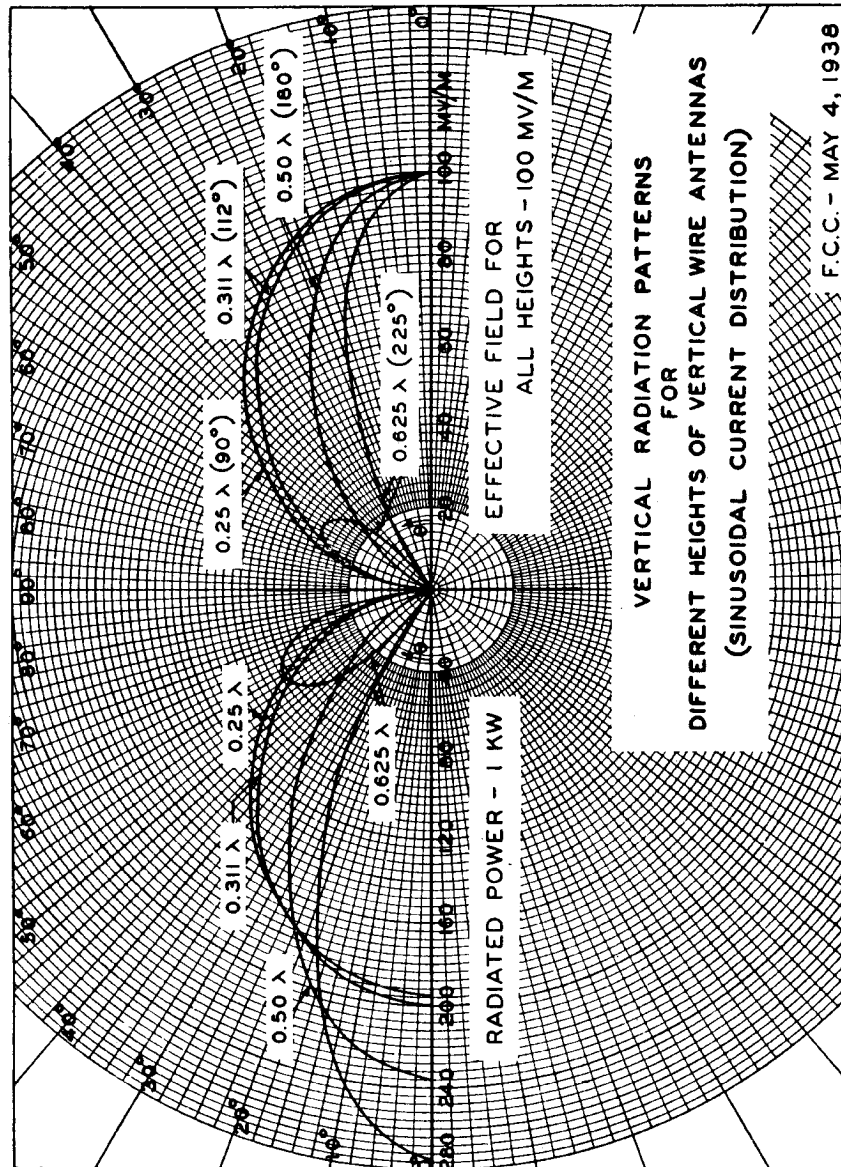
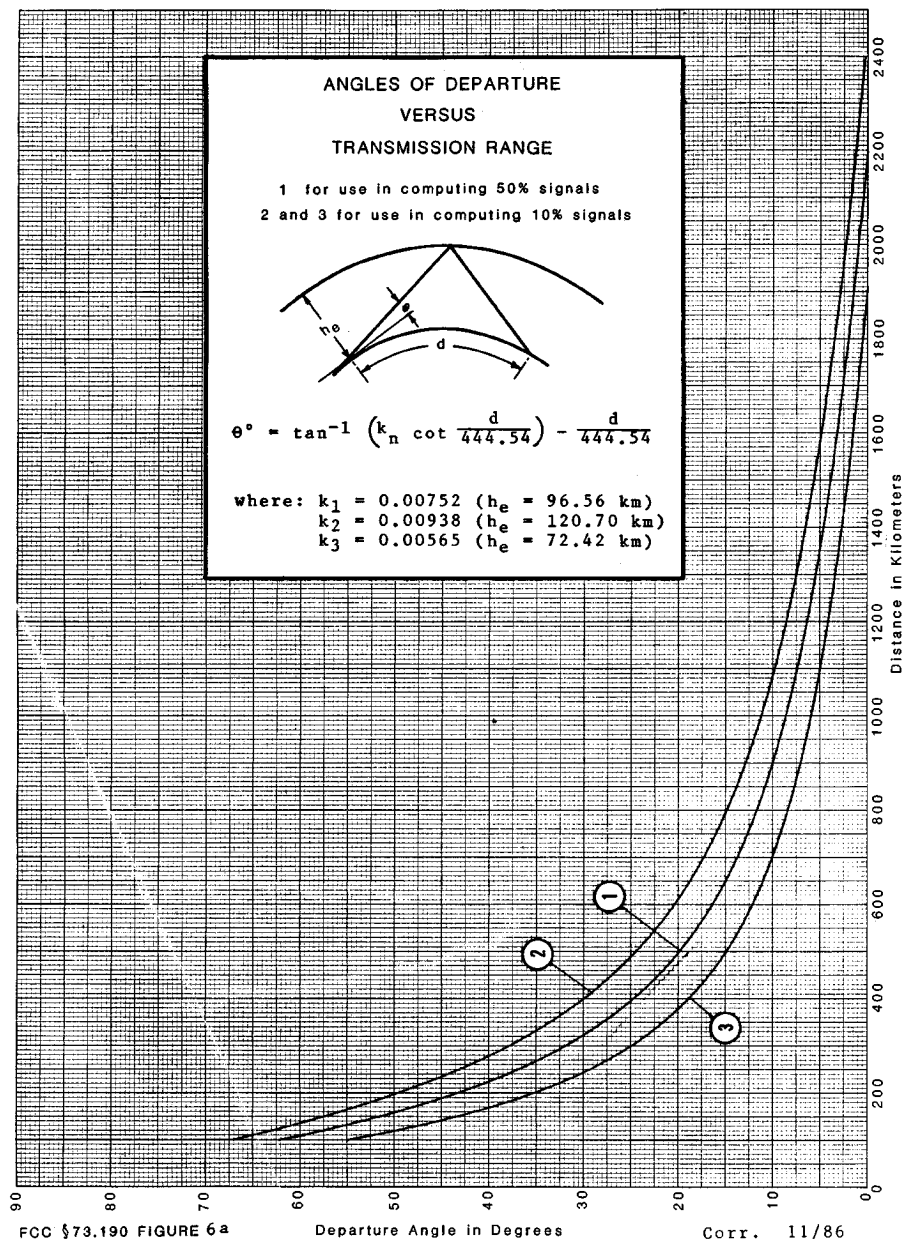


Figure 5

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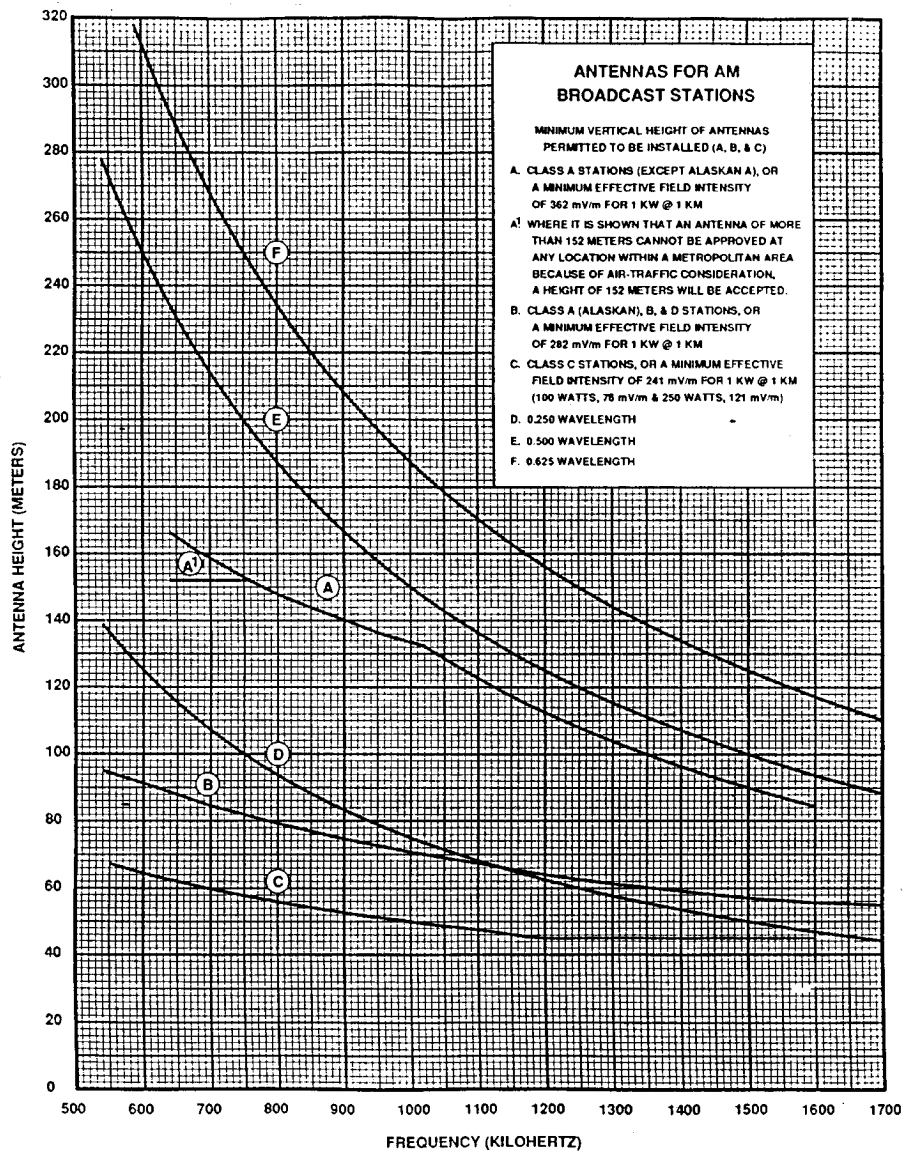


Figure 7

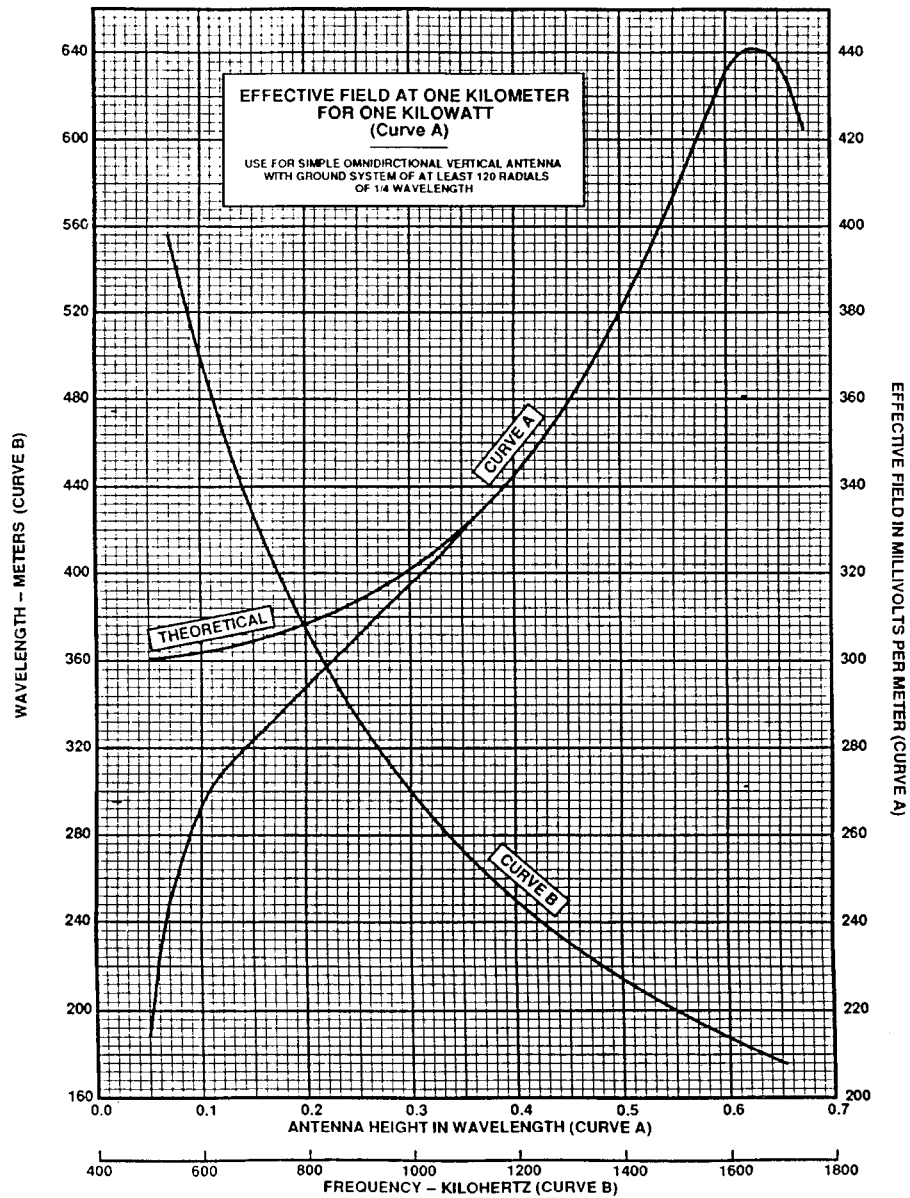


Figure 8

PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

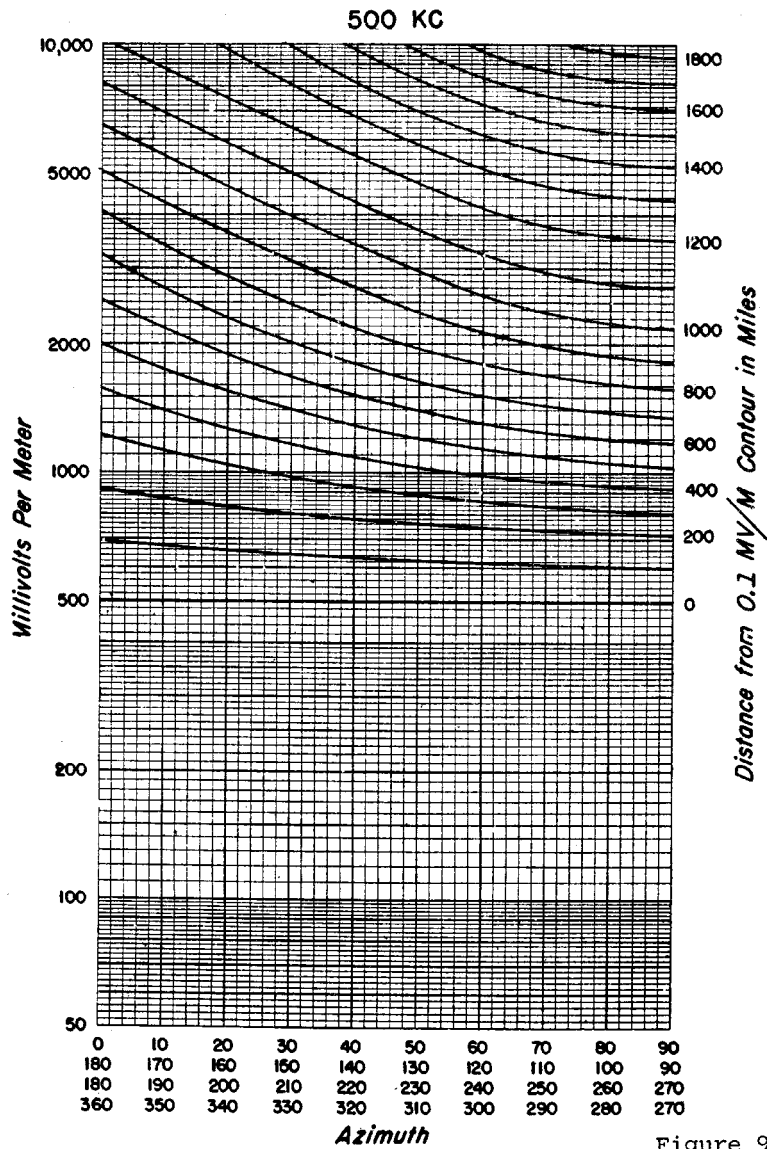


Figure 9

PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

1000 KC

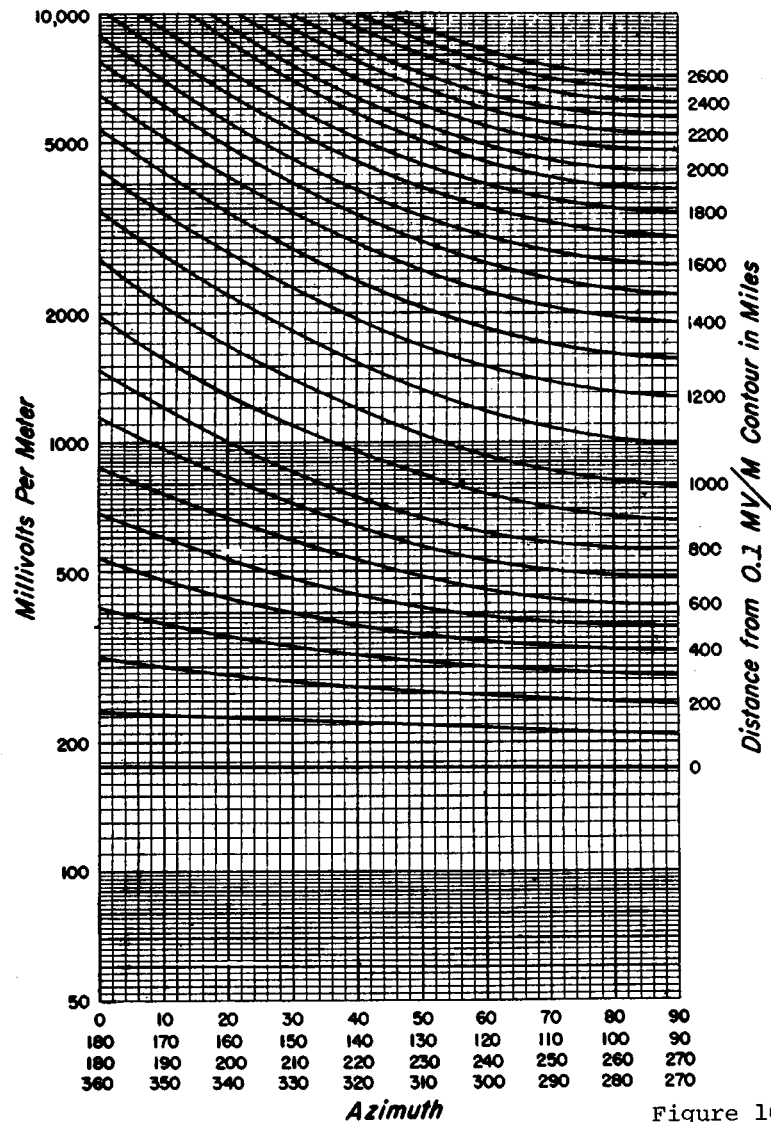


Figure 10

PERMISSIBLE DAYTIME RADIATION FOR CLASS II STATIONS

1600 KC

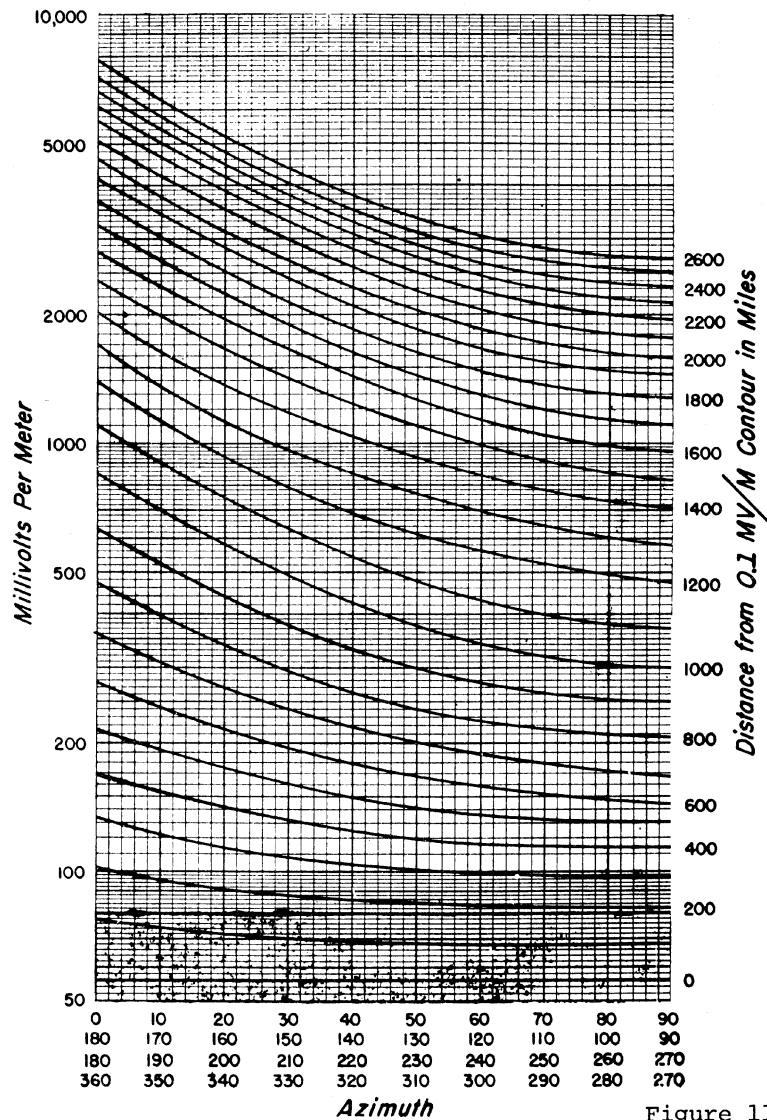
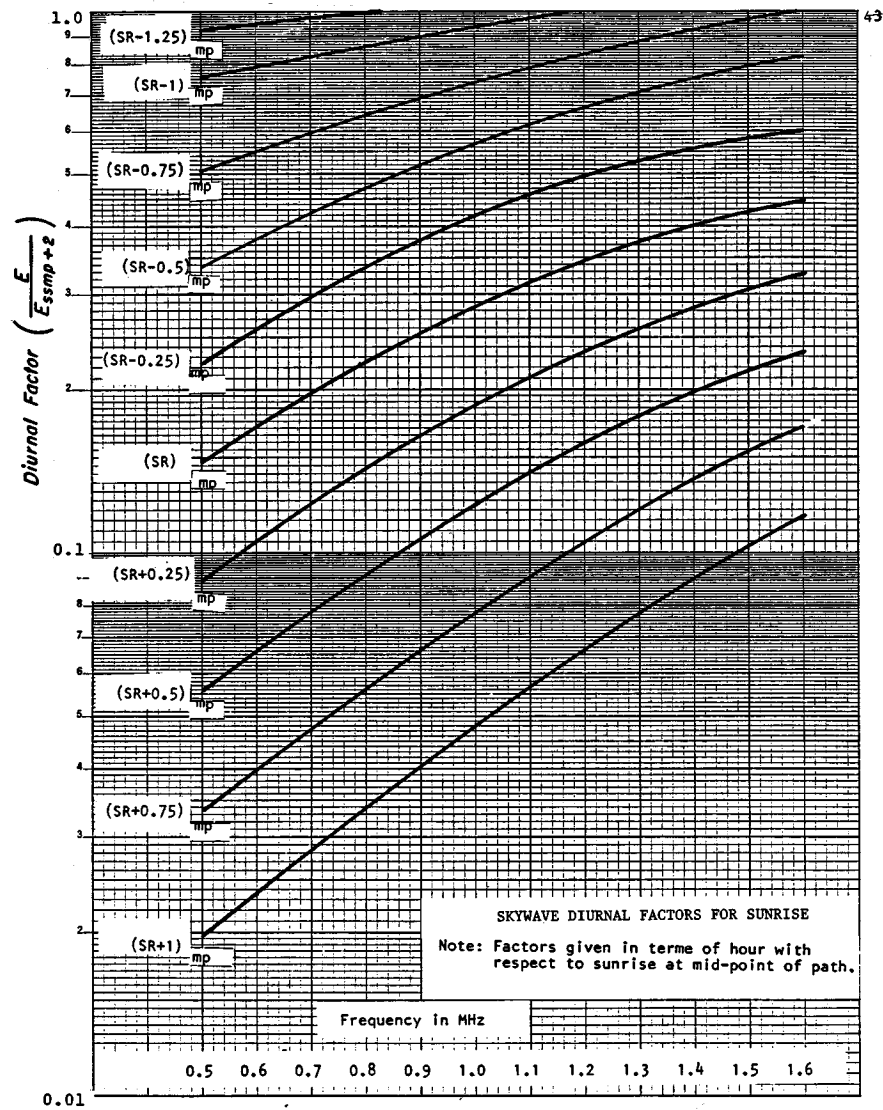
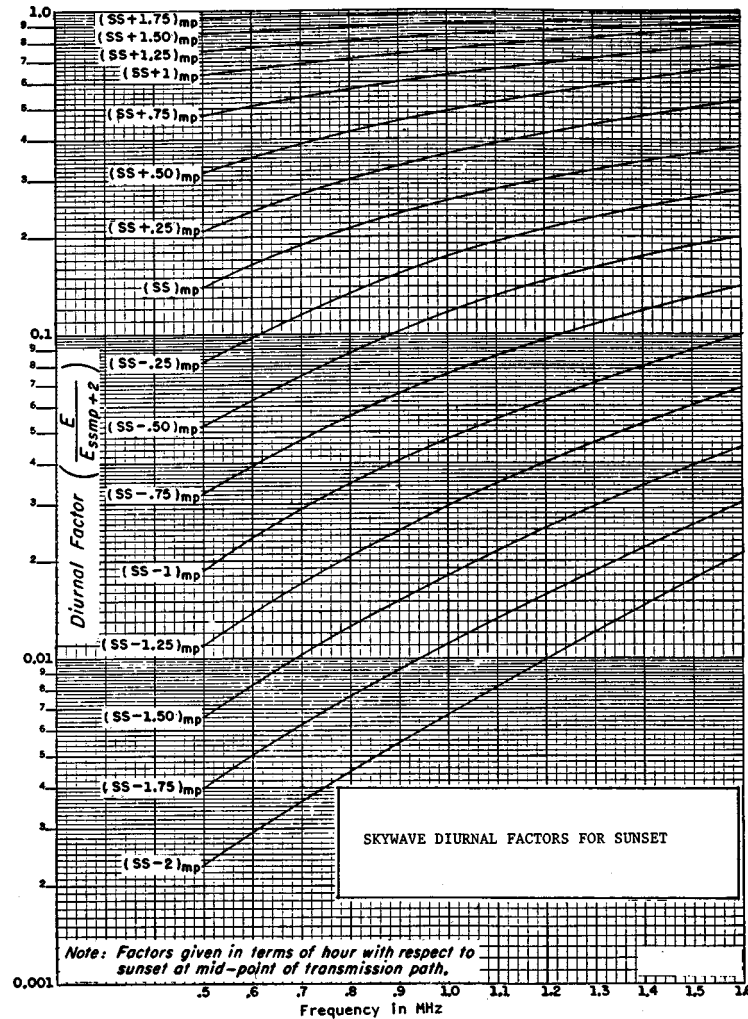


Figure 11



FCC §73.190 Figure 12



FCC §73.190 Figure 13

[28 FR 13574, Dec. 14, 1963, as amended at 30 FR 12720, Oct. 6, 1965; 33 FR 15420, Oct 17, 1968; 48 FR 42959, Sept. 20, 1983; 49 FR 43963, Nov. 1, 1984; 50 FR 18844, May 2, 1985; 51 FR 4753, Feb. 7, 1986; 52 FR 36879, Oct. 1, 1987; 56 FR 64869, Dec. 12, 1991]